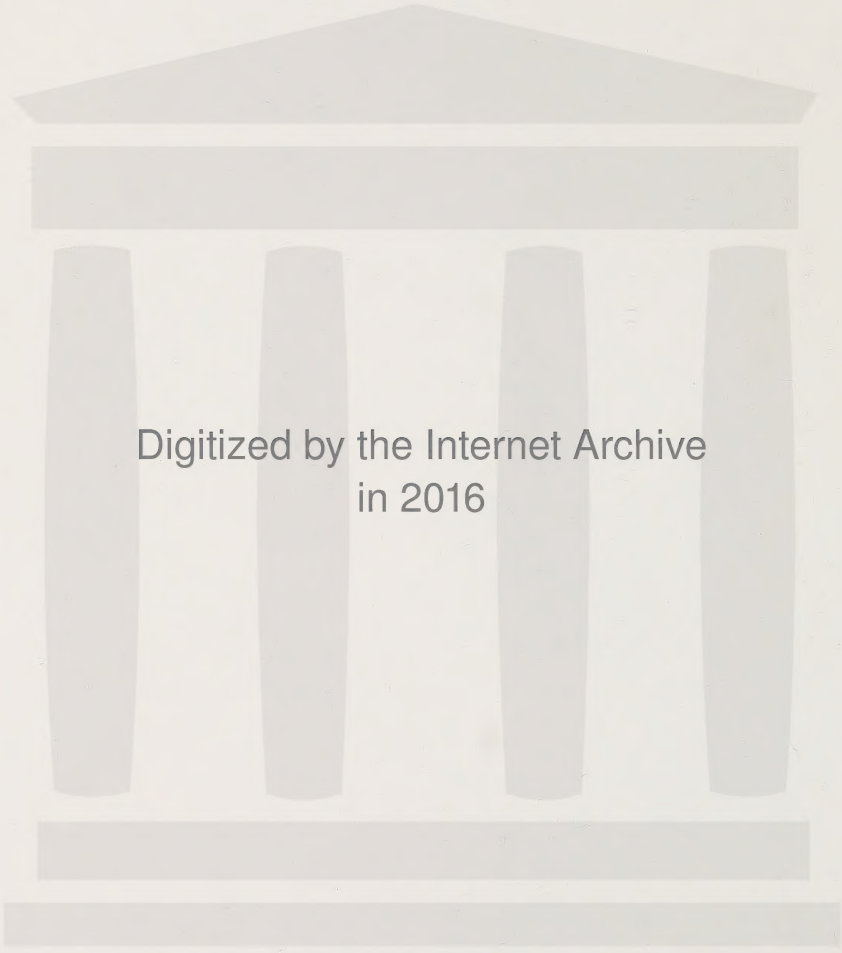
FIELD PEA PRODUCTION MANUAL

Northern and Central Regions

1989

Alberta AGRICULTURE



INTRODUCTION

The Field Pea Production Manual has been written to provide the needed agronomic information in a summarized form on the production of pea crops in central and northern Alberta. This information has been summarized from various sources and includes new information where possible. The following Alberta Agriculture contributors to this manual have addressed the most common questions asked by producers.

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The contributors sincerely thank all the secretaries who assisted in the production of this manual and other staff for their suggestions and reviews. Special acknowledgement to Lois Bonik, Secretary - Barrhead Regional Office, for her assistance in the manual layout, typing and art work.

Good luck in your pea production decisions.

Ken J. Lopetinsky
MANUAL CO-ORDINATOR

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DESCRIPTION AND ADAPTATION

The common cultivated field pea is classified botanically as Pisum sativum. Field peas are annual herbaceous plants with slender succulent stems 2 to 6 feet long. Long vined indeterminate types (internodes 4 to 8 inches long) and short vined determinate types (internodes 1 to 3 inches long) are both produced in Alberta.

Pea foliage is pale green and most varieties produce a white floret. The purple flowered Austrian or Maple types, Pisum sativum spp.arvense, are less commonly grown.

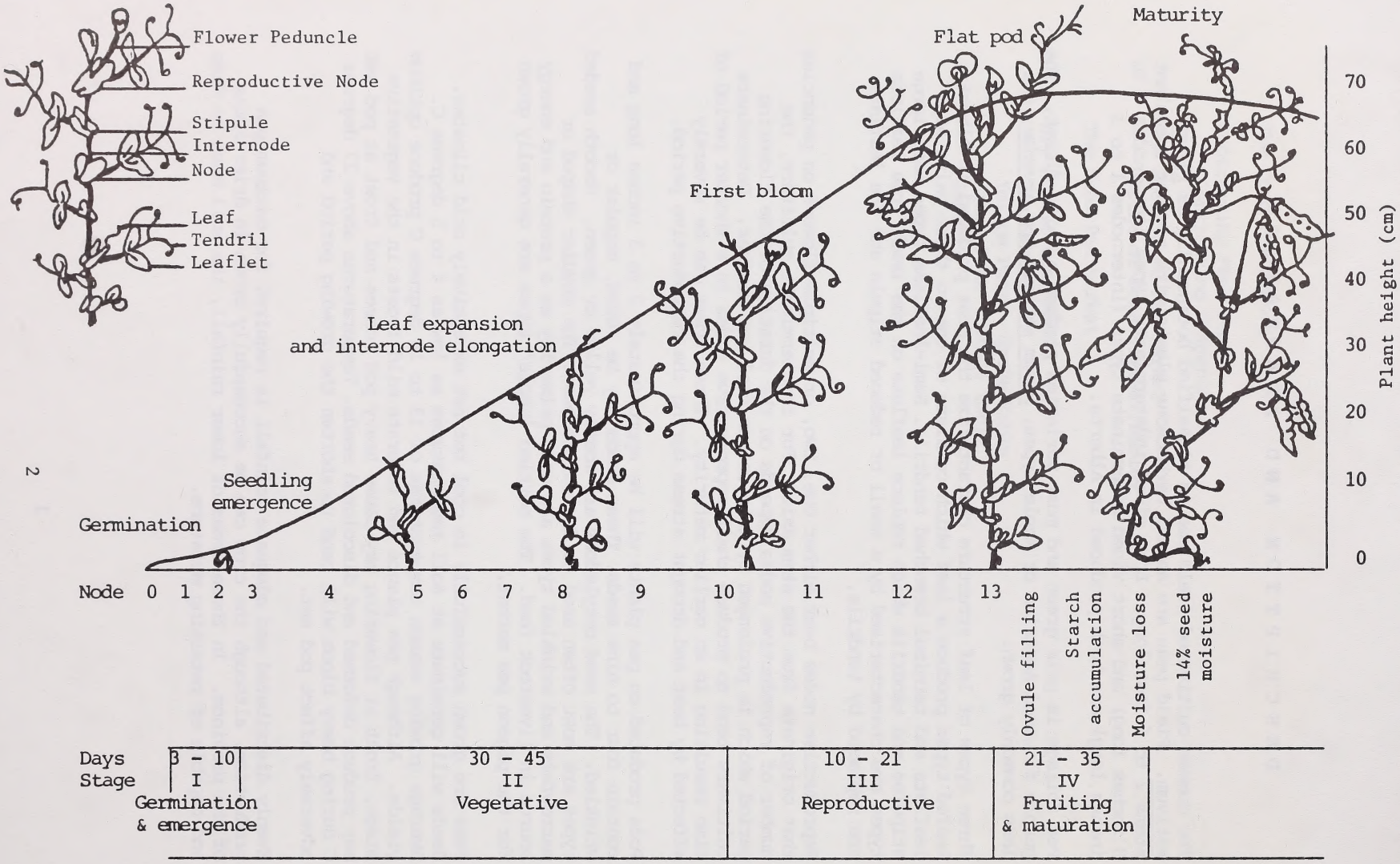
Three types of leaf structure characterize the peas produced in Alberta. Leafed types produce a leaf which consists of one to three pairs of leaflets and terminal branched tendrils. Semi-leafless types have large stipules and tendrils which replace leaflets on the leaf. True leafless types are characterized by a small or reduced stipule and the leaflets are replaced by tendrils.

Reproductive nodes bear either one, two, or multiple flowers on peduncles that originate from the stem axis. For indeterminate cultivars, the number of reproductive nodes depends on the duration of the flowering period which is prolonged by late season cool wet weather. Determinate cultivars tend to produce their reproductive nodes in a shorter period of time resulting in an earlier maturity. These types can be severely affected by heat and drought stress during the reproductive period.

Pods produced on pea plants will be approximately 2 to 3 inches long and contain four to nine seeds. These seeds may be round, angular or wrinkled. The seed cotyledons are mostly yellow or green. Smooth seeded types are most often used as dry edible peas. The angular shaped or marrowfats and wrinkled types are used primarily as a protein and energy source in livestock feed. The mottled 'maple' types are generally grown for the pigeon pea market.

Peas are grown successfully in cool but not excessively cold climates. Seeds will germinate at soil temperatures as low as 4 to 5 degrees C. Average growing season temperatures of 13 to 18 degrees C produce optimum yields. Although pea plants can tolerate mild frosts in the vegetative stage, frost at flowering may cause heavy pod losses and frost at pod set may produce deformed and discolored seeds. Temperatures above 27 degrees C during heavy bloom will tend to shorten the growing period and adversely affect pod set.

Evenly distributed and adequate rainfall is required for maximum pea production, although the crop can be successfully grown in drier areas of the province. In these areas of lower rainfall, the soil must be deep and capable of retaining moisture.



Developmental Stages of 'Alaska' Peas From Planting to Dry Seed Maturity

Dry peas may be grown on a wide range of soil types that are well drained. The crop grows best on loams, clay loams or sandy loams overlying clay. Yields tend to be reduced when the crop is grown on sandy soils that do not retain moisture. Dry peas grow well on soils that have a neutral or slightly acid (pH = 5.5). Peas are not considered a deep rooted crop and tend to be intolerant of shallow or poorly drained soils. An increased incidence of root diseases may result if peas are grown on these types of soils.

V A R I E T I E S

The drop in cereal prices in the mid 1980's caused some farmers to look for other crops to grow. Out of this situation field peas became prominent as a cash crop and an alternate protein source for livestock. This development however was not without problems. A major problem that growers face is which variety and type to grow. The licensed vs. unlicensed variety scenario also creates problems. In particular the unlicensed varieties arrived with very little agronomic data. Field demonstrations over the last 3 years in North Central Alberta have provided information of a local nature useful to growers in selecting varieties.

The following tables represent the varieties that were tested and observed in the Northwest Region in 1988. Not all varieties will be available in the future. No doubt some varieties tested will disappear from the market to be replaced by newer varieties. The varieties tested were only some of those available at the time of setting up the demonstrations. Local data may be available for other areas. All available data should be reviewed before a variety selection is made.

GROWTH AND FLOWERING CHARACTERISTICS

Determinate	Semi-determinate	Indeterminate
Banff	Alaska 81	Century
Jasper	Consort	Magnus
Meteor	Express	Maple
PF 70	Miranda	Tara
Poppet	Princess	Tipu
Puget	Rondo	Trapper
Scout	SS7	
SS3	Sunset 85	
SS5	Victoria	
Signet		
Trojan		
Venus		

SEED CHARACTERISTICS

Variety	Seed Size 1988 1,000 Kernel Weight in Grams	Seed Shape S = Smooth W = Wrinkled I = Irregular	Cotyledon Color G = Green Y = Yellow
Trapper	120	S	Y
Victoria	162	S	Y
Magnus	163	S	Y
Maple	186	S	Y
Trojan	196	W	G
Century	196	S	Y
Scout	194	W	G
Alaska 81	208	S	G
Consort	214	S	Y
SS7	244	I	G
SS5	144	S	G
SS3	199	S	G
Tipu	223	S	Y
Puget	230	W	G
Banff	236	W	G
Signet	239	W	G
Princess	242	S	G
Express	256	S	Y
Tara	241	S	Y
Poppet	253	W	G
Jasper	262	W	G
PF 70	249	W	G
Meteor	270	W	G
Venus	263	W	G
Rondo	322	S	G
Miranda	292	S	Y
Sunset	323	S	Y

MATURITY AND PLANT CHARACTERISTICS

Variety	Relative Maturity* E = Early M = Medium L = Late	Vine Length ** S = Short M = Medium L = Long	Leaf Type L = Leafed SL = Semi-Leafless
Trapper	L	L	L
Victoria	M-L	M	L
Magnus	L	M-L	SL
Maple	L	L	L
Trojan	E-M	M	L
Century	L	L	L
Scout	E-M	M	L
Alaska 81	M	M	L
Consort	M	M	SL
SS7	M-L	M	L
SS5	E-M	S-M	SL
SS3	E-M	M	SL
Tipu	L	L	SL
Puget	M	S-M	L
Banff	E	S	L
Signet	E-M	M	L
Princess	M	M	L
Express	M-L	M	L
Tara	L	L	L
Poppet	M	S-M	SL
Jasper	E-M	S-M	L
PF 70	E-M	M	L
Meteor	E	S-M	L
Venus	E-M	S-M	L
Rondo	M	M	L
Miranda	E-M	S-M	L
Sunset 85	E-M	S-M	L

* Relative Maturity - based on early May seeding
  Early - mature before Aug. 15
  Medium - mature Aug. 15 - Aug. 31
  Late - mature Sept. 1 or later

** Vine Length
  Short = less than 100 cm (up to 40 inches)
  Medium = 100 - 199 cm (40 - 80 inches)
  Long = greater than 200 cm (greater than 80 inches)

1988 AVERAGE GRAIN YIELD OF PEA VARIETIES

(Average of 4 locations - 12 plots)

VARIETY	GRAIN YIELD (Mean) lb / ac *
Rondo	3905 a **
Miranda	3554 b
SS 5	3514 b
SS 7	3419 bc
Sunset 85	3402 bc
Tara	3308 bcd
SS 3	3241 bcde
Jasper	3155 bcdef
Victoria	3050 cdefg
Puget	2942 defgh
Princess	2922 defgh
Tipu	2903 efghi
Alaska 81	2792 fghij
Trojan	2700 ghij
Scout	2645 hijk
PF 70	2621 hijk
Banff	2617 hijk
Venus	2578 hijkl
Signet	2523 hijkl
Trapper	2477 ijkl
Meteor	2400 jkl
Century	2361 jkl
Poppett ***	2243 kl
Maple	2187 l

* all yields have been adjusted to 16.0% moisture content
** means with the same letter are not significantly different
*** low seeding rate for this variety

The following varieties are registered for use in Canada (Jan. 1, 1989). Other varieties may recieve approval in 1989.

Yellow		Green
Bellevue	Tara	Finale (E. Canada)
Century	Tipu	Triumph
Express	Titan	Princess
Fortune	Trapper	
Lenca (E. Canada)	Victoria	

Variety demonstration trials on the preceding 27 varieties and several others have resulted in trends relative to yield potential, ease of harvest, growth potential, and ability to compete with weeds. All of these are important considerations and vary with amount of available moisture. Some general points are:

1. In years of high precipitation during the growing season the long vined indeterminate types have the potential to reach lengths in excess of 6 feet. The growth of determinate varieties on the other hand will be relatively unaffected.
2. In years which have a long open fall the indeterminate varieties have a greatly increased yield potential; an early fall frost can also limit the yield potential of these varieties. Determinate varieties can also have their yield potential severely affected if hot dry weather exists during their short flowering period.
3. Due to the length of the vines, indeterminate varieties can be more difficult to harvest, especially during wet falls.
4. The more erect growth habit of the semi-leafless and leafless varieties makes them easier to swath and quicker to dry in the swath, especially after wet weather.
5. The long vined indeterminate varieties have the potential to compete better with weeds.

These points illustrate that there is no easy solution to the question, "Which variety do I grow?". Points that will help in selecting varieties are:

1. Moisture level at planting time and prospects for a drought or excessive moisture.
2. Soil type and productivity potential, black vs. grey wooded vs. solonetzic vs. acidic, etc.
3. Weediness of the field.
4. Previous crop (high vs. low nitrogen soils)
5. Operator experience with peas.

Tests on protein content over the years 1986 - 1988 show a variation in protein content in different years. While varieties vary in protein content from year to year, they generally remain relative to each other. Because of this variability all samples should be analyzed, especially if the pea crop is destined for sale to the local feed market.

1988 AVERAGE PER CENT CRUDE PROTEIN OF PEA VARIETIES

(Average of 4 sites - 12 plots)

VARIETY	Per Cent Crude Protein *
PF 70	24.6 a **
Jasper	24.2 ab
Venus	24.0 b
Trojan	23.5 c
Trapper	23.4 cd
Poppet	23.2 cd
Century	23.2 cd
Signet	23.2 cd
Puget	23.1 cd
Maple	22.9 d
Scout	22.4 e
Princess	22.3 e
Alaska 81	22.3 e
SS 7	22.1 e
Tara	22.1 e
Victoria	22.0 e
SS 5	21.5 f
Rondo	21.5 f
Meteor	21.3 f
Sunset 85	21.1 fg
SS 3	21.1 fg
Miranda	20.8 gh
Tipu	20.5 h

* per cent crude protein on a moisture basis of 9-10%
** means with the same letter are not significantly different

FIELD SELECTION

Plans to grow peas should include soil tests and field records to save expense and disappointment. A field record is important to pinpoint a possible herbicide residue problem. Herbicides that fit in this category include Lontrel, Tordon, Glean, Ally and Assert.

Soil testing to determine the nitrogen content will help in making field selections. Fields that test high in available nitrogen may be better suited to a cereal or canola since peas are a legume and can produce their own nitrogen for growth. Since peas and other legumes do not like "wet feet", fields with a potential for low spots may not be the best choice especially if heavy rains occur. The yield potential of these fields could be seriously reduced due to drowned out areas, especially if these areas are a significant portion of the total field area.

Select land that is as level and as stone free as possible.

Do not seed peas in successive years on the same piece of land or on land that had peas or canola in the previous 3 - 4 years. Both peas and canola are susceptible to sclerotinia.

In general peas compete very poorly with weeds. Weeds that are a particular problem include quackgrass, perennial sow thistle and Canada thistle. Infestations of wild buckwheat, cleavers and chickweed can make swathing very difficult as these weeds will hang-up on the lifter guards.

SEEDBED PREPARATION AND SEEDING

Seedbed preparation and seeding are two very important aspects in field pea production. Prepare fields much the same way as for cereal grains to achieve a firm, moist seedbed. Early spring cultivation to seeding depth will warm and mellow the soil and promote rapid germination. Soils should be worked when enough moisture is present to reduce clods, but they should be dry enough to prevent compaction and crusting. Overworking results in a thick layer of pulverized and dry soil that is susceptible to severe erosion and crusting. Well prepared seedbeds have a manageable level of crop residue on the surface at seeding time. This will help in proper seed placement at a uniform depth especially when using double disc drills. Early cultivation also encourages the first flush of weed growth which can be controlled by the final cultivation prior to seeding.

Seed early; peas will germinate in soil as cool as 4 - 5°C. Early seeding will advance growth and produce earlier flowering before hot - dry periods in July.

Pea population densities of about 720,000 plants per hectare (72 plants per square metre or 12 plants per metre row) are presently recommended in Alberta. Do not confuse final plant density and seeding rates. Due to the germination and establishment process, the above plant densities produce a seeding rate of approximately 8 seeds/sq. ft. or 1 seed every 3 inches if seeded in six inch rows. Some research data from Europe suggests higher yields are possible with seeding rates of 90 plants per square metre. For optimum plant stands and yields, growers must use good quality seed with good germination. Poor quality seeds leach solutes (for example: sugars, amino acids and carboxylic acids) that promote pathogen growth and cause pre and post emergence damping off and root rot. Poor quality seed results from seed bleaching, weathering, aging, or from insects and diseases. Improper seed cleaning and seeding which cracks or chips the seed coat will also reduce germination.

SEED STANDARDS FOR PEA (Pisum sativum L.)

Grade Name	Maximum Number of Seeds per kg		Minimum % Germination
	Weeds	Other Crops	Pea
1. Canada Foundation No. 1	0	0.0	80
2. Canada Foundation No. 2	0	0.5	70
3. Canada Registered No. 1	0	0.0	80
4. Canada Registered No. 2	0	1.0	70
5. Canada Certified No. 1	0	1.0	80
6. Canada Certified No. 2	0	3.0	70
7. Common No. 1	1	4.0	75
8. Common No. 2	3	10.0	65

Adapted from: Seeds Act, Sept. 1987
Table V, Page 41

Seed Weights (1000 kernel weights) vary due to variety and from year to year because of growing conditions. Drills should be calibrated for each variety and seed lot before seeding to ensure optimum seeding rates.

Seed Drill Calibration

Seed weight (gm) per run per 100 ft. of row X 2 = seeding rate (lb/ac)
- based on 6 inch row spacing
- for other row spacings, multiply 6 inch rate by 'x'/6

Example: for 7 inch row, multiply 6 inch rate by 7/6

FIELD PEA SEEDING RATES

Seed Wt. gm/1000 seeds	Seeding Rate lb/ac 100	120	140	160	180	200	220	240
	seeds/sq.ft.							
150	6.9	8.3	9.7	11.1	12.5	13.9	15.3	16.7
160	6.5	7.8	9.1	10.4	11.7	13.0	14.3	15.6
170	6.1	7.4	8.6	9.8	11.0	12.3	13.5	14.7
180	5.8	6.9	8.1	9.3	10.4	11.6	12.7	13.9
190	5.5	6.6	7.8	8.8	9.9	11.0	12.1	13.2
200	5.2	6.3	7.3	8.3	9.4	10.4	11.5	12.5
210	5.0	6.0	6.9	7.9	8.9	9.9	10.9	11.9
220	4.7	5.7	6.6	7.6	8.5	9.5	10.4	11.4
230	4.5	5.4	6.3	7.3	8.2	9.1	10.0	10.9
240	4.3	5.2	6.1	6.9	7.8	8.7	9.6	10.4
250	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0
260	4.0	4.8	5.6	6.4	7.2	8.0	8.8	9.6
270	3.9	4.6	5.4	6.2	6.9	7.7	8.5	9.3
280	3.7	4.5	5.2	6.0	6.7	7.4	8.2	8.9
290	3.6	4.3	5.0	5.8	6.5	7.2	7.9	8.6
300	3.5	4.2	4.9	5.6	6.3	6.9	7.6	8.3

Goal = 8 viable seeds/sq.ft.

Growers can use the same grain drills for dry peas that are used for cereal and oilseed crops. Hoe press drills are preferred over double disc drills because some seed will be left on the soil surface when using disc drills. Make sure that the drill has large enough seed cups to handle the variety being seeded and adjust the seed cups to obtain an even seed flow. Slow down when seeding (4 mph) especially if using a double disc drill. Maintain constant ground speed for even seed distribution. Avoid shifting gears while moving uphill or downhill as much as possible to eliminate underseeded areas. Air seeders are an alternative to ground driven drills; they plant seeds with precision regardless of slope or varying ground speeds, but uniform depth control may be a problem. For air seeders, very high air speeds may damage pea seeds especially at severe bends or corners in the distribution hoses.

Plant pea seeds at a 2 - 3 1/2 inch depth (5 - 9 cm) in 6 - 7 inch row spacings (15 - 18 cm). Shallow seeding should be avoided. Uniform seeding depth will ensure uniform germination and establishment and a more uniform crop maturity.

After seeding, harrow or harrow pack the field and pick rocks. This step will help at swathing and harvesting.

F E R T I L I T Y

In cereal producing regions, it is important that cropping sequences are developed that include legumes to supply at least part of the nitrogen needs of the cereals. In well planned rotations, legumes are known to increase the nitrogen and phosphorous status of the soil when compared with cereal or fallow rotations. The improved phosphate status is thought to be the result of solublization of phosphate by soil micro-organisms that are promoted in number and activity by legumes in the rotations.

NITROGEN

It is generally accepted that peas do not benefit from nitrogen fertilization when properly inoculated with strains of Rhizobium which are specific to Pisum sativum. Applications of larger amounts of fertilizer nitrogen reduce both nodulation and nitrogen fixation, increase unwanted weed growth and may encourage prolonged plant growth and flowering during periods of cool wet weather and at the time of crop senescence. Small amounts of combined nitrogen (organic and inorganic) can benefit the early stages of seedling development prior to nodule establishment. Nodules form between fourteen and thirty days after germination. Once established, they continue to function throughout most of the growing season and it is difficult to show any benefit from added nitrogen if soil levels are approximately 25-30 pounds per acre.

Effects of Added Nitrogen on Pea Yield in 1988

Added Nitrogen lb/ac	Average Pea Yield lb/ac	
	Barrhead[1]	St. Albert[2]
0	1736.5 A*	2812.3 A*
30	1696.0 A	2811.3 A
60	1217.5 A	2680.7 A

1 - Soil test nitrogen (0 - 12 inch) was 44 lb/ac
2 - Soil test nitrogen (0 - 12 inch) was 54 lb/ac
* Means with the same letter are not significantly different.
Note - Varieties used included Tipu at Barrhead and SS-5 at St. Albert.

Nitrogen (N) starvation can occur at levels of less than 25 pounds available N if the plant is subjected to prolonged drought. Drought causes the nodulation and nitrogen fixation process to break down. Determinate types will be more severely affected than indeterminate types under these situations. Therefore it is recommended to apply up to 15 to 20 pounds N/ac. at seeding if drought conditions are foreseen.

The relative contributions to total plant N of symbiotically fixed and inorganic nitrogen remains a matter of discussion. To a large extent this is due to uncertainties regarding the reliability of the methods available for measuring N fixation. Between 65 and 90 percent of the nitrogen requirements are believed to be "fixed" by the nodules with the remaining 10 to 35 percent supplied by the soil. Estimates of the absolute amounts of nitrogen fixed per year by peas vary. An average dry pea crop of 3000 pounds per acre would contain 690 pounds of protein (assuming the seeds are 23 percent protein). This represents 110 pounds N per acre in the seeds (assuming that 16 percent of the protein is nitrogen). The 110 pounds N per acre is approximately 60 percent of the total N contained in the plants. Therefore, a total of 185 pounds N per acre would be accumulated by an average pea crop, of which 75 pounds N per acre would be returned to the soil in the form of crop residue. As much as 50 percent of this residue nitrogen will be available for a succeeding cereal crop.

PHOSPHORUS, POTASSIUM AND SULPHUR

Field peas respond to phosphorus fertilization where soils are deficient in this element. Adequate phosphorous promotes root growth and nodulation. In most instances, phosphorous is applied with the seed however, excellent response is obtained by banding. If banding equipment is not available, rates of seed-placed phosphorus should not exceed 30 lb P_2O_5 per acre under normal conditions, and 20 lb P_2O_5 per acre for dry soils.

Potassium and sulfur are also required for an optimum yield for peas. Many soils may be deficient, particularly Grey-Black and Grey soils. A soil test must be taken to determine levels of nutrients required. Inadequate levels of these nutrients will affect root nodulation and less nitrogen will be fixed.

Effects of Added Phosphate on Yield of
Tipu Pea in 1988 - Westlock

Amount of Added Phosphate as lb/ac of 11-51-0	Tipu Average Yield lb/ac	
0	1681.7	B*
90	1778.3	A
130	1693.3	AB

* means with the same letter are not significantly different
Note - Available phosphate (soil test) was 24 lb. P_2O_5/ac.

PLANT NUTRIENTS USED BY CROPS

CROP	CROP PART	NITROGEN (N)	PHOSPHORUS (P_2O_5)	POTASSIUM (K_2O)	SULPHUR (S)
			pounds/acre		
PEAS					
2800 kg/ha	SEED	92	24	31	12
42 bu/acre	STRAW	72	11	74	6
(25 cwt)	TOTAL	164	35	106	18
WHEAT					
2690 kg/ha	SEED	60	24	16	4
40 bu/acre	STRAW	25	5	48	6
(24 cwt)	TOTAL	85	29	64	10
BARLEY					
3226 kg/ha	SEED	60	22	20	5
60 bu/acre	STRAW	30	8	67	6
(28.8 cwt)	TOTAL	90	30	87	11
OATS					
3046 kg/ha	SEED	50	21	14	6
80 bu/acre	STRAW	34	13	61	9
(27.2 cwt)	TOTAL	84	34	75	15
CANOLA					
1960 kg/ha	SEED	66	32	16	12
35 bu/acre	STRAW	39	14	67	9
(17.5 cwt)	TOTAL	105	46	83	21

SEED INOCULATION

Field pea seed must be inoculated with Rhizobium leguminosarum (Strain C), specific for peas, lentils, and vetches to ensure that the plants symbiotically fix a portion of their nitrogen requirement. Inoculation methods vary from farm to farm, but the exact procedure sequence is not critical as long as it is convenient.

A sticking agent should be used to make sure sufficient peat based inoculant adheres to the seed. To make sure that sufficient numbers of viable Rhizobium are kept on each seed, use twice the recommended amount of dry inoculant.

Any sticking agent can be used to stick the dry powder to the seed. These include the commercial products Nitracoat or Nutrigum, gum arabic, wall paper paste (that does not contain a bacteriacide), or others such as solutions of powdered milk and sugar. Slurries of the sticking agents and inoculant are convenient for application as long as the slurry mixture is stirred frequently to keep the inoculant in suspension. Auger mounted fungicide applicators work well in applying the slurry to the seed, or one can manually apply the slurry mixture at the bottom of the auger as the seed is being moved into a truck or grain wagon.

If inoculating directly into the drill, allow enough time for the seed to dry sufficiently so that it will flow through the seed cups. Some mixing of the dry seed may be necessary before actual seeding to avoid bridging. Inoculant and inoculated seed should be kept cool and out of direct sunlight. Inoculation is best done during the evening or early morning and only one day's requirements should be inoculated at one time.

SLURRY RECIPE: - (for 150 bushels or 9000 lb. seed)

12 (2.8 kg) Bags Inoculant
+
2 to 3 kg Wall Paper Paste
+
25 Gallons Luke Warm Water

= 30 Gallons of Slurry

Note: - This Recipe results in a double rate of dry inoculant applied.
- Thiram may be added to this slurry if the seed has not been previously treated.

WEED CONTROL IN PEA CROPS

Field pea crops are extremely poor weed competitors at early growth stages, and some varieties are poor competitors for the entire growing season. Good weed control is also important for ease of swathing, swath drying, combining, and high yields. Select fields where weed problems can be properly managed.

Regardless of the herbicides available, extremely weedy fields and fields with excess perennial weeds such as sow-thistle, Canada thistle, and/or quackgrass must be avoided for optimum pea yields.

The following is a summary of available information on the registered herbicides for pea production. More complete information is available in Alberta Agricultures publication: Guide to Crop Protection in Alberta - Part I Chemical, Agdex 606-1 (the Blue Book).

PRE-PLANT INCORPORATED HERBICIDES

- Can be applied either the previous fall or in early spring prior to seeding.
- Fall applications are preferred especially in areas usually dry at seeding time. The required spring incorporation tillage may cause some loss of spring soil moisture.
- In erosion prone areas, incorporated pre-plant herbicides may not be suitable.

1) Avadex
   - Liquid formulation only, apply either spring or fall.
   - No registered mixes for field peas.
   - Rate of 1.7 L/ac.

2) Trifluralin (Treflan, Rival, Triflurex)
   - Liquid or granular formulations for Treflan and Rival. Only liquid formulation of Triflurex available.
   - Granular formulation only registered for fall application.
   - Application rates of products vary due to:
     a. fall vs. spring - higher rates in fall
     b. soil texture - lower rates on sandy soils
     c. soil types and organic matter - lower rates on lower organic matter soils
     d. concentrations of Trifluralin in the product
        Treflan - 545 g/L
        Rival - 500 g/L
        Triflurex - 400 g/L

   Rates

Treflan	- Fall rates	- liquid - 810 ml/ac. - 1.2 L/ac.
		- granular - 8.9 kg - 13.7 kg/ac.
	- Spring rates	- liquid - 610 ml - 1.05 L/ac.
Rival	- Fall rates	- liquid - 650 ml - 1.1 L/ac.
		- granular - 4.5 - 6.9 kg/ac.
	- Spring rates	- liquid - 890 ml - 1.4 L/ac.
Triflurex	- Fall rates	- liquid - 1.1 - 1.4 L/ac.
	- Spring rates	- liquid - 810 ml - 1.1 L/ac.

3) Edge
- dry flowable product
- either spring or fall application
- similar weed control spectrum to the Trifluralin products but somewhat more effective on volunteer cereal and certain weeds such as hemp-nettle.

Rates - Fall - 890 g - 1.13 kg/ac.
Spring - 650 g - 890 g/ac.
- rates depending on soil type and soil texture

4) Sencor / Treflan Mixture - fall pre-plant only
- The combination of these two herbicides provides for better weed control of some weed species and also a wider weed range.

Rates -	Low rate/ac.	High rate/ac.
Sencor 500 DF	225 ml +	345 ml +
+ Treflan 545 EC	810 ml	1.3 L
Sencor 75 DF	150 g +	225 g +
+ Treflan 545 EC	810 ml	1.3 L

Low rate for sandy soils and low organic matter. High rate for loam-clay soils and high organic matter.

POST-EMERGENT HERBICIDES

- The decision to use post-emergent herbicides on pea crops must include the following factors:
  a. If a grassy weed (wild oat) and a broadleaf weed problem exists, at least 2 spray applications are necessary since no registered tank mixes are available.
  b. With some post-emergent herbicides, high water volumes per acre are required - most suggest 80 L/ac. water.
  c. Since good weed control is required in the spring and also at swathing and combining - is there sufficient residual control for a wet August or September period?
  d. Cost of herbicide chosen and the cost of application compared to incorporation costs.
  e. Can you spray at the correct weed and crop stage? Weeds are best controlled with post-emergent herbicides when the weeds are small - less than 5 cm. (2 in.) height. The time frame in which this can be done is short. Most post-emergent herbicides should be applied before the pea crop reaches a 15 - 18 cm. (6 - 7 in.) height. Poor weather for spraying will result in late or no application, the result is a poor pea crop. Late spraying of post-emergent broad-leaf herbicide may cause more injury (yellowing) of the pea crop. This yellowing will usually disappear (7 - 10 days) if the crop is growing under good conditions. However, some yield reduction may occur if the injury is prolonged.

1) MCPA
- only amine and Na-salt registered.
- provides good post-emergent weed control of many annual weeds and suppression of perennial thistles (sow & Canada).
- excellent for stinkweed, mustards, shepherd's - purse

Rates - MCPA - amine - 110 - 280 ml/ac.
- Na-salt - 365 - 605 ml/ac.

2) Sencor
- either 500 F or 75 DF can be used.
- provides for good weed control of the MCPA weeds plus hemp-nettle, chickweed, corn spurry control and others. Does not control thistles.

Rates - Sencor 500 F - 170 - 255 ml/ac.
- Sencor 75 DF - 110 - 150 g/ac.

3) Lexone DF
- only dry flowable registered
- similar weed control spectrum as Sencor

Rates - Lexone DF - 115 - 150 g/ac.

4) Tropotox Plus
- controls the MCPA weed spectrum but provides better suppression of thistles.

Rates - Tropotox Plus - 1.1 - 1.7 L/ac. depending on the weeds to be controlled.

5) Basagran
- registered with Citowett Plus surfactant for peas.
- has a weed control spectrum similar to Sencor or Lexone as well as Canada thistle suppression.

Rates - 710 - 910 ml/ac.
- note the large water requirement of 80 - 160 L/ac.

6) Sodium TCA
- NATA/BAR - FOX D.S.
- controls only green & yellow foxtail, can be mixed with MCPA amine or Na-Salt to control the MCPA weed spectrum plus foxtail.
- some suppression of quackgrass, bluegrass and smooth bromegrass.
- needs moisture for proper performance.

Rates - 1.8 kg/ac.

7) Hoe-Grass 284
- controls wild oats (1-4 leaf stage), green and yellow foxtail, barnyard grass, Persian darnel and volunteer corn.

Note: Apply Hoe-Grass 4 days before any broadleaf herbicide.

Rates - 1.0 - 1.13 L/ac.

8) Poast
- either as Poast and Assist or as a Poast Power Pack and Assist.
- depending on the rates used, weed control will include wild oats, volunteer cereals, Persian darnel, green and yellow foxtail, barnyard grass and quackgrass.
  Note: Allow 4 days between the application of POAST and any other chemical.

Rates - Poast - heavy wild oats - 650 ml/ac.
- heavy volunteer barley - 770 ml/ac.
- quackgrass - 1.78 L/ac.

- Poast (Power Pack)
- heavy wild oats/barley - 570 ml/ac.
- quackgrass - 1.09 L/ac.

9) Excel
- newly registered
- controls green and yellow foxtail, barnyard grass, wild oats and volunteer barley

Rates - 910 ml/ac

General Comments

Wild Oats - Note the longer growth stage application time for Poast (1 to 6 leaf stage) compared to Hoe-Grass 284 (1 to 4 leaf stage) as recommended in the Weed Control Guide.

Volunteer Cereals - Either pre-plant incorporated Edge or post-emergent Poast or Excel can be used. In 1988 better control of volunteer cereals was experienced with Poast compared to Edge. No producer data on Excel.

Thistle Control - No herbicide registered for use in peas will kill thistles; prevention of seed set is the goal. Thistle suppression is usually better with Tropotox Plus or Basagran than with MCPA - Na-salt or amine. However, Basagran only suppresses Canada thistle.

Residual Weed Control - When moisture in late season causes weed re-growth, a residual herbicide will improve the ease of swathing and harvesting. Herbicides such as Trifluralin products, Edge, Sencor and Lexone have residual properties for extended weed control.

Perennial Weed Patches - Successful patch control spraying of Canada thistle & sow-thistle is achieved with Tropotox Plus or Basagran, and use of Poast (high rate) for quackgrass patches.

CROP TOLERANCE - HERBICIDES

HERBICIDE	MANUFACTURER	CROP * TOLERANCE (PEA) 0-9
Avadex	Monsanto	9.0
Basagran	BASF	8.2 - 8.3
Edge	Elanco	-
Excel	Hoechst	8.8
Hoe-Grass 284	Hoechst	9.0
Lexone DF	DuPont	-
MCPA	(numerous)	-
Sodium TCA	Hoechst/Ciba-Geigy	7.0
Poast	BASF	-
Rival	Hoechst	-
Sencor	Chemagro	-
Treflan	Elanco	8.7
Triflurex	Makhteshim-Agan	8.7
Tropotox Plus	May & Baker	8.1

* 9.0 is complete tolerance - some herbicides do not have a numbered rating.
* 7.0 - slightly affected but commercially acceptable.

PEA HERBICIDE COSTS

Herbicide	Rate/acre (low - high rate)	1988 Approx. $Cost/Acre* (low - high rate)
Avadex - liquid	1.7 L	13.50
Basagran	710 ml - 910 ml	15.00 - 19.50
Edge	650 g - 1.13 kg	9.50 - 17.00
Excel	910 ml	13.00
Hoe-Grass 284	1 - 1.13 L	13.50 - 15.50
Lexone DF	115 - 150 g	7.00 - 9.50
MCPA - amine	110 - 280 ml	.50 - 1.00
- Na-salt	365 - 605 ml	1.00 - 2.00
Bar-Fox D.S., Sodium TCA - granular	1.8 kg	10.50
Sodium TCA + MCPA	1.8 kg + MCPA	11.00 - 12.50
Poast - Poast	325 ml - 1.78 L	10.00 - 55.00
- Power Pack	570 ml - 1.09 L + assist + ammonium Sulphate	19.00 - 35.00
Rival - liquid	650 ml - 1.4 L	6.00 - 12.50
- granular	4.5 - 6.9 kg	10.00 - 15.00
Sencor - flowable	170 - 225 ml	7.50 - 9.50
- dry flowable	110 - 150 g	7.00 - 9.50
Treflan - liquid	610 ml - 1.2 L	6.00 - 12.00
- granular	8.9 - 13.7 kg	10.00 - 15.00
Sencor + Treflan	225 ml + 810 ml - 345 ml + 1.3 L	18.00 - 29.00
	150 g + 810 ml - 225 g + 1.3 L	18.00 - 27.50
Triflurex - liquid	810 ml - 1.4 L	5.50 - 9.00
Tropotox Plus	1.1 - 1.7 L	8.00 - 12.50

* Note - Approximate 1988 cost ($0.50 increments) may not reflect present cost. Some herbicide manufacturers have changed prices for 1989. Please check with herbicide suppliers.

HERBICIDE* SELECTOR CHART

* PLEASE NOTE:

a. Although the herbicide is listed, specific weed control may vary from suppression to complete control. Check the Blue Book - Agdex 606-1 or label information for specific weed control levels.

b. Not included in this selector chart:
   a) Gramoxone as a pre-plant or pre-emergent herbicide for top growth weed control.
   b) Reglone at time of swathing for top growth weed control.
   c) Mixtures of Sencor/Treflan and Sodium TCA/MCPA.

c. Formulations and herbicide groupings include:
   a) Trifluralins - Treflan, Rival, Triflurex
   b) Lexone - only the DF formulation
   c) MCPA - only amine and sodium salt formulations

WEED	AVAILABLE HERBICIDES
Buckwheat (Tartary)	Lexone DF, MCPA, Sencor
Buckwheat (Wild)	Edge, MCPA, Trifluralins
Chickweed (Common)	Basagran, Edge, Lexone DF, Sencor, Trifluralins
Cocklebur	Basagran, MCPA
Cow Cockle	Edge, Trifluralins
Darnel (Persian)	Hoe-Grass 284, Poast, Trifluralins
Foxtail (Green)	Edge, Excel, Hoe-Grass 284, Poast, Trifluralins, Na-TCA
Goosefoot	MCPA
Grass (Barnyard)	Edge, Excel, Hoe-Grass 284, Poast, Trifluralins
Groundsel (Common)	Basagran, Sencor
Hemp-nettle	Edge, Lexone DF, MCPA, Sencor
Knotweed	Trifluralins
Kochia	Edge, MCPA
Lambs-quarters	Basagran, Edge, Lexone DF, MCPA, Sencor, Trifluralins, Tropotox Plus
Mustards (including volunteer rapeseed)	Basagran, Lexone DF, MCPA, Sencor, Tropotox Plus
Nightshade	Basagran, Edge
Pigweed (Prostrate)	Edge, Trifluralins, MCPA
Pigweed (Red root)	Basagran, Edge, MCPA, Trifluralins, Sencor Tropotox Plus

Herbicide Selector Chart continued. . .

Purslane	Basagran, Edge, MCPA, Rival, Treflan
Radish (Wild)	Basagran, MCPA, Tropotox Plus
Smartweeds	Basagran, Edge, Lexone DF, MCPA, Sencor, Tropotox Plus
Sow-thistle	MCPA, Tropotox Plus
Spurry (Corn)	Basagran, Edge, Lexone DF, Sencor
Stinkweed	Basagran, Lexone DF, MCPA, Sencor, Tropotox Plus
Thistle (Canada)	Basagran, MCPA, Tropotox Plus
Thistle (Russian)	Basagran, Edge, Trifluralins, Sencor
Volunteer Cereals	Edge, Excel, Poast
Wild Oats (Vol.)	Avadex BW, Edge, Excel, Hoe-Grass 284, Poast, Trifluralins

I N S E C T S A N D D I S E A S E S

INSECTS

To date, insects have not been a problem with field pea production in north-central Alberta, and using sound management practices and proper field rotation will help prevent future problems. Pea weevils, leaf hoppers, loopers, thrips, pea moths and plant bugs are insects that may be found in pea fields but do not seem to have the potential to become a major problem at this time. Growers should be aware of the following insects.

Pea Aphids. Aphids suck sap causing discoloration, stunting, leaf curl and damage to buds and flowers which can affect yield and quality of the peas. This aphid normally lives on alfalfa and clover but causes little damage to these crops. The problem arises when they migrate to pea fields to feed. During the summer pea aphids have 7 to 15 generations with 100 offspring per generation. If large numbers are noticed and plants look wilted and unthrifty control may be warranted. Upon inspecting the field, if large numbers of aphid predators are noted, an insecticide may not be required. To identify predators consult: Enemies of Field Crops Pests in Alberta, Agdex 620-3.

Recommended insecticides: Cygon - 225-405 ml/acre
Pirimor - 60-110 g/acre
Malathion - 1.4-1.8 kg (25% W.P.)/acre
Lannate - 900 ml/acre

Grasshoppers: Grassshoppers feed on a variety of crops, and peas are no exception; yield and quality losses occur by the defoliation caused by the grasshoppers. Grasshoppers usually originate from dry uncultivated soil and have one generation per year. In pea crops, populations of 8 or more per m^2 may warrant spraying. If spraying is necessary contact your local District Agriculturist. No products are currently registered but there is a possibility of a special permit being acquired to apply an insecticide.

Cutworms: Cutworms cause damage by cutting the plants off just below the soil surface, activity usually occurs at night. Be sure not to confuse cutworms with seedling blight or damping off. These diseases result in the wilting of the plant as opposed to the plant being cut off or severed by cutworms. Cutworms generally have one generation per year. Control can be achieved by discing the infected area and if done early reseeding may be an alternative.

Recommended insecticide: Ambush - 57-120 ml/acre

Blister Beetle: This insect feeds on the youngest leaves and flowers of plants. It is a large black insect approximately 3/4 inch long in the adult stage and will be seen in groups. The infestations tend to be localized and only become a problem when natural food reserves of wild legumes, vetches and milkvetches are used up. Specific control measures are rarely warranted.

Wireworms: Problems with wireworms seldom occur but can happen when peas follow forage grasses in a rotation. Wireworms feed on the seed and below ground plant parts. Usually a seed treatment with an insecticide such as Lindane prevents problems from arising.

In summary, with all insect infestations, consult "Enemies of Field Crop Insect Pests in Alberta" Agdex 620-3, to determine which insects may provide natural control. Consult the "Guide to Crop Protection in Alberta", Agdex 606-1, for further insecticide information. If you plan to spray, please notify beekeepers in the area.

DISEASES

To manage diseases in peas utilize the tools at hand, such as good cultural practices. You can reduce plant disease levels by proper tillage, seeding practices, fertilization, crop rotations and field selection. Do as much as possible to prevent disease buildups so problems do not arise.

Ascochyta Blight: This fungus overwinters on the seed and crop debris but not in the soil. Warm humid conditions favor fungi growth: infection usually starts at the bottom of the plant and works upward. Leaves, stems and pods are affected and will have tan spots irregular in shape with dark brown margins. Stem and pod lesions will also be sunken. Spores are formed and released from black fruiting bodies the size of a pinpoint located in the tan spots. Even though no variety is completely resistant to Ascochyta and no fungicide is registered for control, growers are encouraged to use seed treatments, a four year rotation and to bury crop debris.

To date, Ascochyta Blight has not been a factor in yield reduction but has been present on the seed in north central Alberta. Seed tests can be done to see if Ascochyta is present; use seed contaning as low a level as possible. Collect approximately 1 to 2 lbs. of seed and send to a lab of your choice. Turn around time is approximately two weeks.

Two labs that will do the tests are:

United Grain Growers Ltd.
Seed Division
Box 6030
Station C
EDMONTON, Alberta
T5B 4K5
Phone: 479-2051

Norwest Labs
9938 - 67 Avenue
EDMONTON, Alberta
T6E OP5
Phone: 438-5522

Powdery Mildew: This disease starts with minute specks on leaves that develop into powdery spots. The spots enlarge until the plant is covered with a white powdery coating. This disease primarily affects plants later in the growing season and has a lower potential for crop loss than peas affected by Downy Mildew. Plants turn bluish-brown and eventually die. It is not known how the disease overwinters. Powdery mildew is spread by wind blown spores. Dew without rain enhances the development of the disease but rain acts as a control by washing the spores off and destroying them. Burying crop debris and locating fields away from past years fields helps control the disease. TARA is a resistant variety. Wettable Sulphur (92% WP) has been shown to be an effective control measure.

Downy Mildew: This disease appears as fluffy, white to bluish cottony patches on the underside of leaves. Plants tend to be affected at a young age. The disease acts systemically and therefore affects the entire plant. This fungus overwinters in the soil. It quickly infects young seedlings and spreads to other plants. Cool moist weather favors this disease.

To aid control be sure to follow a three to four year rotation to prevent spore buildup in the soil. Buying seed from low rainfall areas will also help. There are currently no resistant varieties or chemicals registered for control. Due to this disease infecting plants early, the potential exists for large yield losses to occur.

Root Rot: Roots and the lower part of stems develop brown-black lesions. In severe cases, parts of the plant below ground are often rotted and constricted. Plants will appear stunted, lose lower leaves and die. The disease is soil borne therefore use a four year rotation. Beans and alfalfa are also hosts. Planting in fields which have any of the following characteristics: compacted soil, water logged, heavy clay in nature, cold and in a high rainfall area; results in stress conditions which may cause root rot to occur.

A fungicide seed treatment with Thiram or Captan will help reduce the amount of root rot. Thiram can be applied in a mixture with the inoculant and sticking agent.

Sclerotinia Stem Rot: This fungus survives in the soil. It becomes a problem during extended periods of warm moist weather in crops with a heavy canopy. Pea plant stems are infected. They become soft and are covered with a layer of white, cottony type growth. The plant wilts and dies prematurely.

There are currently no resistant varieties or registered chemicals to control sclerotinia in peas. To control culturally, follow a four year rotation and avoid planting peas following other susceptible crops such as peas, beans, sunflowers, canola and mustard. Also control cruciferous weeds and canola which are agents for sclerotinia.

There have been reports of peas harvested with a high content of sclerotia. Yield losses can occur and crop rotations should be carefully watched . There is also some hesitation by buyers to purchase these peas.

Seedling Blight: The disease causing organism is present in most cultivated soils and frequently affects pea seed that is small, weak, and otherwise damaged. Pea seedlings fail to emerge or become stunted and unthrifty. Seeds will be soft, brown and encased in a white mold. Often brown stem lesions will be noted on unthrifty plants.

Wet and cool soils favor infection. There are no resistant varieties. To control, treat the seed with a registered fungicide such as Thiram or Captan and use good quality seed.

For additional information growers may wish to refer to:

Diseases of Pulse Crops in Western Canada, Agdex 632-1, Alberta Agriculture. Diseases of Field Crops in Canada, The Canadian Phytopathological Society, Box 437, Harrow, Ontario, NOR IGO.

P R E - H A R V E S T M A N A G E M E N T

Field peas, depending on type and seeding date, require a growing season of approximately 85 to 110 days. Be prepared to begin harvest when a majority of plant dry down is achieved and before pods are brittle, dry and prone to shattering. Monitor fields and prepare equipment prior to harvest. These management practices can eliminate a lot of harvest problems when the pea crop reaches the proper stage for swathing or straight cutting.

A heavy, long vined pea crop can best be handled with a narrow swather table or by taking a narrow cut (12 to 15 feet) with a wider table. A wider swather center discharge adjustment will also be beneficial. For further details on center discharge adjustment refer to Alberta Agriculture publication "Bulky Swaths Improved with Modified Swathers", Agdex 745-1. It is important to match the swath size and density to the combine capacity so that a uniform feed is achieved.

Swathers should be equipped with a rigid tooth pick-up reel and with vine lifters mounted on the cutter bar. The vine lifters, spaced approximately 12 inches apart, work well for medium and long vined crops. If the crop is short (12 to 18 in. height), the lifters may have to be spaced closer together, for example 6 inches apart.

Combines with straight cut headers should also be equipped with vine lifters spaced similarly as for swathers.
Skid plates or gauge wheels will enhance swathing or straight cutting of a pea crop. These features allow for a very short stubble cut and will assist in fewer table height settings.

It is important to monitor a pea field prior to ideal swathing or straight combining time. The best way to monitor a field is to swath an outside round or two in the field a week or two before the estimated time of crop maturity. While opening up the field look for:

- the direction in which the crop is laying
- green areas in hollows and draws
- the advancement of plant dry down from the bottom to the top of the plants

Correct crop maturity:

- when at least 80% of the field has turned color (from a green to a yellow-tan).
- when the bottom 1/2 of the pods have matured (dry wrinkled orange peel texture).

S W A T H I N G

Pea fields that have reached full physiological maturity will dry down very quickly if weather conditions are warm and dry. Swathing should commence as soon as possible after the field has reached a yellow tan color and the seed is at 20 - 25 per cent moisture. The majority of the pods on the plants should be tan to yellow in color and should contain seeds that are difficult to dent with a thumb nail. At this stage a few of the top pods will be a lime green color and have a wrinkled texture. The seeds in these pods will break apart when pressed between thumb and finger and will, for yellow cotyledon types, be turning from bright green to pale green or yellow green.

Lower areas of the field which remain green should be ignored when the proper swathing or straight cutting time approaches for a majority of the field. Delayed cutting, to allow these areas to advance in maturity, may jeopardize quality and quantity of the remainder of the crop.

All commonly grown pea varieties have weak hollow stems and most will lay over or lodge when heavy in pod. The best method of swathing or straight cutting a lodged pea crop is at right angles to the direction in which the crop is lying. Swath peas slowly, 3 to 4 mph, and produce an even swath. If bunching occurs in the swath, adjustment of the pick-up reel (backwards or forwards) may alleviate the problem.

The dessicant, Reglone, registered for use in pea crops, can be used to dry down a pea crop. Faster and more even dry down with Reglone can be achieved compared to natural dry down during short cool fall days. Apply Reglone a few days later than the proper swathing stage. Wait approximately 7 days, straight combine or swath and follow immediately with a combine. Mix Reglone with Agral 90, 1 L. per 1000 L. of spray mixture, and apply at:

1) 2.75 L. in 45 L. of water for heavy weedy stands
or
2) 2 L. in 45 L. of water for light cleaner stands.

Reglone will dry down the crop very quickly and will not allow for further maturity of any immature seed.

Under ideal weather conditions the combine should follow almost immediately behind the swather or at best, the swaths should only remain in the field for a day or two. Light fluffy pea swaths are prone to wind damage. If at all possible, swath peas in the direction of the prevailing wind. A pea crop will suffer less damage as a standing crop if weather conditions are cool and wet.

If unable to combine quickly pea pods may shatter, but only after two or three weeks, during which time the pods have been subjected to a series of wetting and drying and hot days.

The following formula can be used to estimate the yield of a pea crop:

Plants/ft.^{2} x Pods/plant x Seeds/pod x 1000 k.wt.* x .1 = approximate yield (lb/acre)

* 1000 k. wt. = weight in grams of 1000 seeds

COMBINING FIELD PEAS

Several factors affect the harvesting of peas. Combining is the easiest if: (1) the width of swather cut is well matched with the crop yield and the combine capacity and (2) the moisture content of the peas is approaching dryness. These circumstances also require the least power and good separation takes place readily. The proper feeding rate of the swath is much easier to maintain if the combine is equipped with a variable speed pickup. A sprocket change on the pickup drive may be needed to reduce the pickup speed to that suited for pea swaths.

The following general guidelines are suggested for threshing peas with conventional combines. Rotary combines have also been successfully used.

a) Cylinder Speed - will depend on the cylinder diameter, moisture content and stripper bar. Based on the moisture content, the following RPM speeds are guidelines:

Seed Moisture Content	Cylinder Speed
18 - 22%	800 - 1000 RPM
14 - 16%	500 - 800 RPM
very dry	300 - 500 RPM

Note: that the higher speed of each RPM range is suggested for very heavy, bulky swaths. Higher cylinder speeds will help avoid plugging in heavy crops. Lower cylinder speeds will reduce seed cracking and splitting in thin swaths and lower seed moisture content.

b) Concave clearance - 1 1/2 inch front and 1/2 inch rear

c) Chaffer sieve - 5/8 - 3/4 inch

d) Lower sieve - 1/4 - 5/16 inch depending on the variety (seed size and shape). Round hole sieves give good results.

e) Airflow setting - A high air flow will reduce tailings volume and result in a clean grain sample.

Straight combining - Peas can be direct combined if the combine is fitted with vine lifters on the knife guards and a pickup reel. The crop should be uniform, and at full maturity with kernel moisture levels at 20 - 22% or lower. The header height must be controlled very closely to ensure that very little dirt is picked up. Dirt and dust can coat the peas permanently and therefore give reason for down grading.

The SUND pickup harvester is a new development for direct combining of peas. This pickup pulls the pea foliage from the ground. The stems of peas need to be quite dry for this system to function at its best.

Dessication and Time of Application - The use of the dessicant Reglone may be an advantage where crop maturity is uneven or growth of other crops or weeds is a problem.

In field peas the dessicant can be applied with ground equipment or by aircraft.

Apply Reglone when the peas have matured. The application can be made when the bottom and mid-area pods will have turned brown and yellow and the top pods are pitted and are starting to turn yellow. Harvesting can take place 7 - 10 days after spraying provided the moisture content is 22% or less.

Combine Unloading - High speed augering can cause considerable splitting of peas especially when threshed dry. Combine hoppers should be unloaded at low engine speed to avoid splitting.

Peas can be safely stored at 16% seed moisture content provided the seed has been threshed relatively clean. Any amount of damp plant debris such as thistle buds, green wild oats or cereal kernels could however cause spoilage to occur unless these were removed or the grain is aerated or dried.

STORAGE, DRYING AND HANDLING OF PEAS

DRYING

Peas can be stored at 16% moisture content in bins with an aeration system. This moisture content is not safe storage moisture content under all conditions; this is simply the moisture content at which the grain trade is prepared to purchase a farmer's product without penalty. It is probably safe moisture content for storage over winter if the seed is put into bins cool or is cooled by mechanical ventilation shortly after storage.

There are two very good reasons for not harvesting seed at too low a moisture content. Selling the crop below maximum moisture content represents a loss to the producer. The other point which must be considered is that drier seeds are more easily damaged in threshing and handling. This is a problem with pulse crops particularly if they are to be used for seed stock.

Properly harvested and dried peas can be stored for considerable length of time. This is true if storage conditions do not change. Unfortunately, conditions do change as a result of variations of the environment outside the storage structure.

As the fall proceeds, the average outside air temperature drops causing a temperature differential across the walls of the storage structure. This in turn lowers the air and grain temperatures near the storage wall more quickly than the rest of the grain. The difference in temperature starts air moving down the bin wall and upward through the centre of the warmer grain mass. The air moving through the centre of the bin becomes warmer and picks up moisture from the grain. When the warm moist air hits the cool upper surface of the grain, condensation occurs and spoilage results.

In spring the problem is reversed. Warming action from the sun on the outside of bin causes moist air to move up along the storage wall and down the centre of the grain mass. Condensation then occurs on the bottom of the bin.

Moisture migration due to natural convection can be prevented by eliminating or drastically decreasing the temperature differential across a grain storage wall. This can be accomplished by slowly cooling the peas in the fall and warming them in the spring. The practice of ventilating stored grain with low airflow rates to maintain grain quality is called aeration.

Aeration helps reduce storage problems by minimizing temperature and moisture variations and by cooling the grain. Aeration is NOT a grain drying system and should not be used as one. However, under ideal weather conditions, some drying may occur during aeration.

Grain can be tempered (cooled or warmed) by either negative or positive aeration systems. With either system, a tempering (cooling or warming) zone moves through the grain. The movement of the tempering zone completely through the grain is one cooling or warming cycle. Once a cycle had been started, operate the fan continuously until the zone moves completely through the grain. The time required to complete each cycle depends almost entirely on the aeration airflow rate.

Airflow rates for aeration are normally 1 to 2 litres of air per second per cubic meter of grain (or 0.08 to 0.16 cubic feet of air per minute per bushel of grain).

The time for one cooling or warming cycle to completely pass through grain can be estimated by the following formula: Number of hours to cool or warm the grain =

$$\frac{195}{\text{Airflow rate } (L/s\text{-}m^3)}$$

or

$$\frac{15}{\text{Airflow rate (cfm/bu)}}$$

Where $L/s\text{-}m^3$ = litres per second per cubic meter
cfm/bu = cubic feet per minute per bushel
1 cfm/bu = 13 $L/s\text{-}m^3$

Grain temperature and moisture content determines the allowable storage time (AST) or how long the peas can be kept before spoiling. As moisture content increases for a given temperature, the AST for drying and storing decreases. Also as temperature increases, AST decreases. Mechanical damage to the peas and the amount of foreign material also affects AST. A clean crop and whole seeds are more resistant to mold. For long term storage grain should be dried as soon as possible after it comes from the field. Delay in drying decreases the AST.

It should be stressed that the average moisture content throughout the grain bin does not determine the storability of grain. Spoilage may occur at isolated locations in the bin where crop moisture is high. Peas can be stored in a bin at a relatively low average moisture content of 15%; a moisture content range between 14% and 18% is not safe for long term storage because of the excessive moisture content (18%) of part of the grain.

If the crop is harvested damp, careful drying is necessary. Drying too rapidly can damage the peas. Drying too slowly can create conditions favourable for mold growth resulting in deterioration of quality. If the crop is to be used for seed purposes, the drying should be done in two stages if the moisture content is to be reduced by 5% or more. Drying air temperature should also be lower for grain to be used for seed. Temperature of the drying air also depends on the crop end use as shown below.

3 1/2" CELL

BOARD OF GRAIN COMMISSIONERS FOR CANADA

G.R.L. CENTURY PEA CHART JULY 1967

SAMPLE WEIGHT 250 GRAMS

Meter Reading	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	Meter Reading
25.0	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	12.5	12.4	12.3	12.2	12.1	12.0	11.9	25.0
25.5	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	12.5	12.4	12.3	12.2	12.1	12.0	25.5
26.0	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	12.5	12.4	12.3	12.2	12.1	26.0
26.5	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	12.5	12.4	12.3	12.2	26.5
27.0	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	12.5	12.4	12.3	27.0
27.5	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	12.5	12.4	27.5
28.0	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	12.5	28.0
28.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	12.5	28.5
29.0	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	29.0
29.5	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	29.5
30.0	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	30.0
30.5	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	30.5
31.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	31.0
31.5	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	31.5
32.0	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	32.0
32.5	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	32.5
33.0	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	33.0
33.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	33.5
34.0	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	34.0
34.5	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	34.5
35.0	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7	35.0
35.5	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	35.5
36.0	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	36.0
36.5	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	36.5
37.0	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1	37.0
37.5	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	37.5
38.0	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	38.0
38.5	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	38.5
39.0	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	39.0
39.5	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	39.5
40.0	16.6	16.4	16.4	16.2	16.2	16.0	16.0	15.8	15.8	15.6	15.6	15.4	15.4	15.2	15.2	15.0	15.0	14.9	14.8	14.6	40.0
40.5	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	40.5
41.0	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	41.0
41.5	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	41.5
42.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	42.0
42.5	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	42.5
43.0	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	43.0
43.5	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	43.5
44.0	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.4	44.0
44.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	44.5
45.0	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6	45.0
45.5	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	45.5
46.0	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	46.0
46.5	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	46.5
47.0	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	47.0
47.5	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	47.5
48.0	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	48.0
48.5	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	48.5
49.0	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	49.0
49.5	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	49.5
50.0	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	50.0
50.5	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	50.5
51.0	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	51.0
51.5	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	51.5
52.0	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	52.0
52.5	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	52.5
53.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	53.0
53.5	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	53.5
54.0	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	54.0
54.5	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	54.5
55.0	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	17.4	55.0
55.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	17.5	55.5
56.0	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6	56.0
56.5	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	56.5
57.0	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	57.0
57.5	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	57.5
58.0	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	58.0
58.5	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	18.0	58.5
59.0	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1	59.0
59.5	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	59.5
60.0	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	60.0
60.5	20.3	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	60.5
61.0	20.4	20.3	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	61.0
61.5	20.5	20.4	20.3	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	61.5
62.0	20.6	20.5	20.4	20.3	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	62.0
62.5	20.7	20.6	20.5	20.4	20.3	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	62.5
63.0	20.8	20.7	20.6	20.5	20.4	20.3	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	63.0
63.5	20.8	20.8	20.6	20.6	20.4	20.4	20.2	20.2	20.0	20.0	19.8	19.8	19.6	19.6	19.4	19.4	19.2	19.2	19.0	19.0	63.5
64.0	20.9	20.8	20.7	20.6	20.5	20.4	20.3	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	64.0
64.5	21.0	20.9	20.8	20.7	20.6	20.5	20.4	20.3	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	64.5
65.0	21.1	21.0	20.9	20.8	20.7	20.6	20.5	20.4	20.3	20.2	20.1	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	65.0

Crop	Maximum Temperature of Drying Air °C (°F)			
	Seed Grain	Commercial Grain		Feed
		Mixed During Drying	Unmixed	
Peas	43 (110)	71 (160)	60 (140)	93 (199)

Use of an aeration bin along with a heated air dryer is desirable to dry pulse crops. The crop is dried to within 2% of the desired final moisture content in the dryer and then transferred, while hot, into the aeration bin. It is allowed to sit in the aeration bin for at least six hours, during which time the moisture content of the individual kernels tends to equalize, and then cooled to outdoor temperature. During this time approximately 2% of moisture will be removed. An airflow of 6.5 - 13 L/s-m^3 (0.5 - 1 CFM/bu) should be provided to cool the peas. There are two advantages of using the dryeration system. One is that it increases the capacity of the dryer, but perhaps the more important one is that allowing peas to temper and then to cool slowly produce less stress on individual seeds and therefore less damage due to cracking.

Natural air drying offers best possibilities for most farmers as a method of reducing grain moisture without damage. The rate of drying is dependent on outside temperature and humidity. Grain should be checked regularly for moisture content during drying. It is possible to remove too much moisture in good drying weather.

An airflow of 26 L/s-m^3 (2 CFM/bu) or higher should be provided to dry pulse crops with unheated air. In a natural air drying system, air is forced into the bottom of the bin. The air picks up moisture as it moves through the grain and exits through the openings in the top of the bin. Grain at the bottom begins to dry first and gradually a drying zone moves through the grain. Below the drying zone, grain reaches a moisture content that is in equilibrium with outside air conditions. Above the drying zone, the grain is still near its initial moisture content.

HANDLING AND STORAGE

Every year large supplies of seed are lost because of mechanical injury. Generally, the greatest mechanical injury occurs during harvesting, but injury can also occur any time seed is processed or handled, including planting. Pulse crop seeds are very fragile and are extremely susceptible to injury at low moisture contents. However, mechanical injury can also occur at moisture levels normally considered safe for storage.

Perhaps the simplest way to prevent mechanical injury is to harvest seed only at moisture levels which minimize mechanical damage but still permit safe seed storage. Another way to minimize mechanical injury is to use a combine with a more gentle threshing action than usual. Slower cylinder speed, wide concave setting and low speed operation of combine auger and grain loaders will reduce chipped, cracked, split and broken seeds.

Mechanical damage during processing is usually not excessive but could become serious when proper precautions are not taken. If the crop is to be used for seed, care should be taken in selecting a proper conveyor. To reduce mechanical injury to pea seeds, the conveyors which are designed to handle fragile material should be used.

Belt conveyors should be used to move pulse crops in and out of storage. Although belt conveyors are more expensive than other types, the reduction in damage makes the investment worthwhile. Flat belts, belts with molded rubber flights and belt-in-tube conveyors are available from several manufacturers. Belt conveyors with molded rubber flights can elevate grain to a height of 45 degrees without cracking or grinding. These conveyors are supported on wheels for easy moving from bin to bin. Formed steel covers provide all-weather protection. Molded rubber belts save clean up time and the self-cleaning bed prevents buildup under the belt.

Augers and chain and flight conveyors are not desirable for handling peas, particularly at lower moisture contents. If either type of conveyor is used, run as full as possible at reduced speed.

Use shallow bins to handle pea seeds to reduce the lengths of free fall as much as possible. Bean ladders should be used for deep bins where the free fall is greater than 10 feet. A bean ladder is a rectangular tube having a series of zig-zag curved baffles inside. The open type has openings on two sides 90^{O} to the inside curved baffles and is used inside the bins or tanks. The closed type does not have the side openings but is enclosed with sheet metal on all sides and is used in place of spouting material when steep spouts cannot be avoided. As the seed flows through the ladder they follow a cascade zig-zig course and never obtain as high a velocity as they would in free fall.

E C O N O M I C S

The following budget is prepared to provide an estimate of expected costs and returns for field peas. This information can be a useful quide in decision making, but keep in mind that costs vary between producers because of the differences in land, cultural and management practices. Choice of harvest method, whether swath and combine or dessicate and straight combine, will have a major influence on the costs of production.

At the same time, returns will vary considerably if the crop is sold for seed, for dry edible peas, or for livestock feed. All peas will qualify for feed grades but only certain varieties will meet the dry edible requirements. No additional benefits such as improved soil tilth and nitrogen fixation are quantified.

This budget is based upon CRD #237, December 1987 and updated to Spring 1989. This publication is available from district agriculturists.

The projected yield is 50 bu/acre of feed peas priced at $4.00/bu. If the crop meets seed or edible standards this value would be considerably higher.

Fertilizer and chemical costs are based upon projected 1989 prices. Machinery operating costs may seem exceptionally high, but this reflects, among other things, dramatically slower seeding, swathing and combining rate than is the case with cereal crops. In each case, the rate is approximately 2/3 that of cereals. Interest on operating capital is calculated at 12% for one year. Hail insurance represents $100/acre coverage at 1 1/2 times the normal rate of 5%, as is the case with canola.

Deducting direct costs from crop sales gives a gross margin of $85.50/acre from which all indirect costs must be covered. Taxes and miscellaneous overhead are indirect cash costs while labor and depreciation are imputed costs. Calculations include 2.1 hours of operational labor @ $6.50 per hour. Depreciation is considerably higher for peas than for cereal crops, again reflecting slower rates of operation.

Growers are encouraged to insert their own figures in the right hand columns where they differ from those suggested to arrive at their cost of production.

Pea Matrix

As in other crops, there are so many variables in production and marketing of peas that it is difficult to devise a budget which will cover all situations. In an attempt to cover these "what if" situations, two matrices have been prepared using a variety of pea prices and corresponding yields or seed costs. For example, the budget shows a gross margin of $85.50 at a yield of 50 bushels per acre and a price of $4.00 per bushel. If instead the grower realizes a 40 bushel yield at $4.00 per bushel, he could expect a lowered gross margin of $45.50 per acre as per Table 1. If, on the other hand, he realized $5.00 per bushel instead of $4.00 per bushel his gross margin would then increase to $135.50.

Unlike most field crops, pea production costs are dominated by seed costs which account for approximately 35% of direct cash costs. For this reason Table 2 is prepared which accommodates several combinations of market prices and seed costs.

1989 FIELD PEA BUDGET

		Per Acre	Your Estimate
Crop Sales	50 bu/acre @ $4.00/bu	200.00	
Direct Cash Costs:	Seed (200 lbs/acre)	40.00	
	Fertilizer 8-38-15 (70 lb/ac)	10.56	
	0-0-0-90 (10 lb/ac)	1.55	
	Edge (1 kg/ac)	14.90	
	MCPA Na Salt (280 mL/ac)	1.10	
	Inoculant and sticker	2.00	
	Equipment operation and maintenance	24.62	
	Interest on operating capital	12.27	
	Hail insurance ($100/ac coverage)	7.50	
Total Direct Cash Costs		114.50	
Gross Margin		85.50	
Indirect Costs	Taxes	4.00	
	Miscellaneous Overhead	4.66	
	Operator Labor 2.1 hours	13.65	
	Building and Equipment Depreciation	47.78	
Total Indirect Costs		70.09	
Gross Operating Profit		15.41	

Breakeven yield needed to cover Direct Cash Costs is 28.6 bu/acre

Breakeven yield needed to cover Direct and Indirect Costs is 46.1 bu/acre

Note: To convert this budget to a cash flow projection, taxes and miscellaneous overhead costs should be added to Total Direct Cash Costs. In addition, land costs such as debt retirement (if applicable), or rent should be included.

PEA PRODUCTION GROSS MARGINS

TABLE 1 FIELD PEAS: GROSS MARGIN AT VARIOUS PRICES AND YIELDS

Market Price ($/bu.)	Yield (bu./ac.) 20	30	40	50	60	70	80
6.00	5.50	65.50	125.50	185.50	245.50	305.50	365.50
5.50	(4.50)	50.50	105.50	160.50	215.50	270.50	325.50
5.00	(14.50)	35.50	85.50	135.50	185.50	235.50	285.50
4.50	(24.50)	20.50	65.50	110.50	155.50	200.50	245.50
4.00	(34.50)	5.50	45.50	85.50	125.50	165.50	205.50
3.50	(44.50)	(9.50)	25.50	60.50	95.50	130.50	165.50
3.00	(54.50)	(24.50)	5.50	35.50	65.50	95.50	125.50

TABLE 2 FIELD PEAS: GROSS MARGIN AT VARIOUS MARKET PRICES AND SEED COSTS

Market Price ($/bu.)	Seed Cost (¢/lb) 10¢	15¢	20¢	25¢	30¢
6.00	205.50	195.50	185.50	175.50	165.50
5.50	180.50	170.50	160.50	150.50	140.50
5.00	155.50	145.50	135.50	125.50	115.50
4.50	130.50	120.50	110.50	100.50	90.50
4.00	105.50	95.50	85.50	75.50	65.50
3.50	80.50	70.50	60.50	50.50	40.50
3.00	55.50	45.50	35.50	25.50	15.50

THE FEED PEA MARKET

Expanding demand in the European Common Market countries has opened a very significant market for Canadian feed peas. These countries tend to be short of high protein livestock feeds and have historically imported large quantities of soybean meal. In order to reduce its dependence on imported soybean meal, the ECC is subsidizing the use of peas in animal feeds. The resulting increase in demand is a bonus for Canadian pea producers.

Pea prices in 1988 strengthened by $60 per tonne due to a smaller North American pea crop and a tight soybean supply/demand balance. In Alberta however, the estimated 1988 pea output of 122,000 tonnes is sharply higher than the 1987 output of 45,000 tonnes. The following table shows trends in North American production.

	1982	1983	1984	1985	1986	1987	1988
				,000 tonnes			
U.S. Peas	162	178	150	131	158	184	171
Canada Peas	135	117	131	169	238	442	365
Total	297	295	281	299	396	626	536

Peas are essentially a protein supplement, and as such must be price-competitive with soybean meal; thus, we cannot sell overpriced peas. There are indications that local prices may be too high relative to the European market, and there may be some downward pressure on values until the two markets come into line. To add to this, Canadian peas must compete with Australian produced peas which are entering the European market. There is a further concern over the amount of dockage in Canadian peas and, as a result, most grain companies are now buying peas basis zero dockage. Previously, up to 8% dockage was allowed by most companies.

CONTRACTING FEED PEAS

Because of the price volatility of the feed pea market, many producers are interested in locking in a price for the impending year's production. Grain companies offer two types of contracts: general production contracts and deferred delivery contracts.

A general production contract requires delivery of all peas produced from a specified acreage. In this contract, yield risks are shared between the producer and the grain company. If the crop is partially or totally destroyed by frost, hail, drought or other natural disaster, only that part which is harvested need be delivered.

On the other hand, a deferred delivery contract, specifies a given quantity of peas, even if they must be purchased from other growers to fulfil the contract. Some companies offer an "Act of God" clause which cancels the contract in the event of a natural disaster. Producers are advised to contract less than 50% of their crop prior to harvesting. Once it is in the bin, of course, the grower may wish to contract the entire crop.

With either type of contract, although price is important, the producer must be aware of other provisions stated in the contract. These might include percentage dockage allowed, delivery requirements, maximum moisture content and other conditions.

The following list includes most companies which are interested in contracting peas in central and northern Alberta. For additional listings of companies refer to "Alberta Special Crops Market Synopsis", available at local D.A. Offices.

Alberta Wheat Pool - Calgary

Dockage: payment based on zero dockage
Delivery points: 55 specified points in Alberta, including:
Region 5:
Barrhead, Morinville, Pibroch, Stony Plain, Thorhild
Region 6:
Brownvale, Fairview, Dawson Creek, Grande Prairie, Manning, Donnelly, Tangent, Wanham, Whitelaw
Maximum Moisture: 17%
Conditions of Sale:
1. Elevator delivery based on daily price.
2. Deferred delivery contract - based upon delivery to one of the above specified points or a producer car with payment based on Canadian Grain Commission weights and dockage at time of unloading at Thunder Bay.
3. General Production Contracts.
Contact: Dave McFarlane at 290-4868 or your local elevator manager.

Balfour Grain - Gibbons

Dockage: 0%
Delivery points: Gibbons or producer car at any point in Alberta
Maximum Moisture: 17%
Conditions: All feed peas. Production contracts on specified acreage with price established in January. Deferred delivery contracts based upon production contract prices.
Contact: Stuart Shaw, Gibbons 923-2414

Cargill Grain - Lethbridge

Dockage:	0%
Delivery points:	Local Cargill elevators or dealer cars in Alberta
Maximum Moisture:	17%
Conditions:	Daily bid price on delivery to local elevators Deferred Delivery Contract on dealer cars unloaded at Thunder Bay, basis Canadian Grain Commission weights and dockage.
Contact:	Earl McLeod at 452-5331 or local Cargill elevator manager

Cen Alta Grain - Edmonton

Dockage:	0%
Delivery:	Dealer cars to any point in Alberta
Maximum Moisture:	17%
Conditions:	General production contracts and deferred delivery contracts; seed and inoculant available; acts as an agent for Northern Sales Ltd.
Contact:	Rod Turner, 1-800-232-7302 or 468-4440.

Continental Grain - Morinville

Dockage:	0% ($7/ton cleaning charge if dockage exceeds 8%).
Delivery:	Morinville, Spirit River, Nampa or dealer car at any point in Alberta
Maximum Moisture:	16%
Conditions:	Deferred delivery contracts based upon daily prices
Contact:	Don Leavitt, Morinville 1-800-272-9605 or 939-3223

Elders Grain (formerly Allstate) - Surrey, B.C.

Dockage:	0%
Delivery:	Dealer car anywhere in Alberta
Maximum Moisture:	16%
Conditions:	General Production Contracts for all production from a specified acreage - Will inspect field at least once during summer and assist with production tips - 3 pricing alternatives - fixed; pooled; open market - cleaned at Morinville or Wetaskiwin Deferred Delivery Contract - purchased on contract basis - dealer car
Contact:	Laurie Berg, Lloydminster 1-800-522-4135 Stan Peterman, Morinville - 939-4700

Premier Grain Ltd. - Lethbridge

Dockage:	8% foreign material
Delivery:	producer/dealer car
Maximum Moisture:	17.5%
Conditions:	Spot Sales Deferred delivery contracts (Thunder Bay) General production contracts
Contact:	Darren Bodell, Premier Grain, 329-4450 or 1-800-661-8066 Joe St. Denis, St. Denis Seed Farms, Legal, 961-3368

Columbia Seeds - Vauxhall

Dockage:	6% foreign material
Delivery:	F.O.B. the bin
Maximum Moisture:	17.5%
Conditions:	General production contracts Seed production contracts
Contact:	Harry Arnott, Columbia Seeds, 654-2158 Joe St.Denis, Legal, 961-3368 Northern Alberta Ken Kusk, Kelsey, 375-2333 Central Alberta

Palliser Grain - Edmonton

Dockage:	8% allowable foreign material
Delivery:	At Edmonton or dealer car anywhere in Alberta
Maximum Moisture:	16.5%
Conditions:	Sales on a flat or spot cash basis Canadian Grain Commission grade and dockage at terminal No General Production Contract but will give a deferred settlement
Contact:	Bruce Horner, Edmonton - 453-6627 or 1-800-252-9356

United Grain Growers - Winnipeg

Dockage:	levels over 8% (including cracks and splits) deducted from purchase weight
Delivery:	any UGG elevator
Maximum Moisture:	16.5%
Conditions:	Elevator delivery at daily price or Deferred Delivery Contract for desired amount to be delivered to local elevator based upon daily price.
Contract:	Norman Fodness, 250-7200 or local elevator manager

THE LOCAL FEED PEA MARKET

Feedmills and livestock producers are excellent potential markets for locally grown peas. Hog, dairy, and poultry rations can all benefit by the inclusion of peas. Hog rations are particularly well suited for peas because of the excellent lysine content. It is expected that the local pea market will evolve a price schedule based on protein content, with premiums paid for high protein peas. Feedmills indicate a genuine interest in the use of peas but require an assured supply before peas will be regularly incorporated into their rations.

Pea growers should be aware that the Alberta Grain Commission is operating a feed pea exchange. Interest in the exchange has stemmed mostly from hog producers located in Central Alberta. One of the major problems has been matching the location of the buyer with that of the seller. For those interested in buying or selling through the feed pea exchange, the toll free number is 1-800-232-1983.

Traditionally, peas have been compared to soybean meal on a protein basis only. A computer program developed by Sam Jaikaran, an Alberta Agriculture nutritionist, also takes into account lysine and energy. New tables have been developed which value peas nearly 30% higher than previous tables. The following table can be used by the livestock producer to value peas he produces or purchases from other growers. Note that the chart is based on the peas having 22% protein on a dry matter basis.

PRICE OF PEAS (22%) VS. SOYMEAL & BARLEY

	BARLEY PRICE $/TONNE										
Soy Price $/Tonne	100	105	110	115	120	125	130	135	140	145	150
250	177	179	182	185	187	190	192	195	198	200	203
260	182	184	187	190	192	195	197	200	203	205	208
270	187	189	192	194	197	200	202	205	208	210	213
280	192	194	197	199	202	205	207	210	213	215	218
290	197	199	202	204	207	210	212	215	218	220	223
300	202	204	207	209	212	215	217	220	223	225	228
310	206	209	212	214	217	220	222	225	227	230	233
320	211	214	217	219	222	225	227	230	232	235	238
330	216	219	222	224	227	230	232	235	237	240	243
340	221	224	227	229	232	235	237	240	242	245	248
350	226	229	232	234	237	239	242	245	247	250	253
360	231	234	237	239	242	244	247	250	252	255	258
370	236	239	242	244	247	249	252	255	257	260	263
380	241	244	247	249	252	254	257	260	262	265	268
390	246	249	251	254	257	259	262	265	267	270	272
400	251	254	256	259	262	264	267	270	272	275	277
410	256	259	261	264	267	269	272	275	277	280	282
420	261	264	266	269	272	274	277	280	282	285	287
430	266	269	271	274	277	279	282	284	287	290	292
440	271	274	276	279	282	284	287	289	292	295	297
450	276	279	281	284	287	289	292	294	297	300	302
460	281	284	286	289	292	294	297	299	302	305	307
470	286	289	291	294	296	299	302	304	307	310	312
480	291	294	296	299	301	304	307	309	312	315	317
490	296	299	301	304	306	309	312	314	317	320	322
500	301	303	306	309	311	314	317	319	322	324	327

THE SEED PEA MARKET

Production of seed peas offers a third option for the pea producer. Several established seed growers have diversified into seed pea production. These growers have the expertise to grow pedigreed cereal and oilseed crops and have readily adapted to seed pea production. Many of them offer seed peas for sale directly to other farmers. The novice grower should not begin with seed production, but after gaining some experience with peas, seed production can become an interesting and rewarding endeavor.

Pedigreed seed of public varieties is readily available to all growers; however, SeCan varieties can be propagated only by SeCan members. Some seed companies offer production contracts for the multiplication of exclusive or SeCan varieties, while other companies prefer to purchase cleaned, bagged and sealed seed for resale. Seed houses generally prefer to deal in pedigreed seed but most will carry a supply of common seed.

DRY EDIBLE PEA MARKET

Although the majority of field peas grown in central and northern Alberta will sell for feed purposes, many of the currently registered varieties are suitable for human consumption. There is a definite preference for certain varieties of both yellow and green cotyledon round peas, with Century being the variety of choice. Peas which attain edible standards usually command a premium in the market place. At present, this premium is very small, but can reach in excess of $1.00 per bushel.

PEA GRADES

All peas will qualify for livestock feed but only those which attain Canadian Grain Commission specificiations can be sold for human consumption. Official grades are No.1, No. 2, No. 3 or Sample Canada. Color forms a part of the grade description as does variety (upon request), for example, "Peas No. 1 Canada Yellow" or "Peas No. 1 Canada Century Variety". Grades are determined by the following characteristics: color, foreign material, cracks, splits and damaged seed. Tables outlining the requirements for various grades of yellow and green peas are provided. Of note, cracks and splits are considered dockage in edible peas, unlike feed peas where usually only foreign material is dockage.

YELLOW PEAS - PRIMARY AND EXPORT GRADE DETERMINANTS

The variety or color may be added to and become part of the grade name

	Standard of Quality					Maximum Limits of					
						Damage					
Grade Name	Color	Peas of Other Colors	Foreign Material		Cracked Seed Coats Including Splits	Shrivelled	Splits	Heated	Insect Damage	Other Damage	Total Damage and Splits
			Ergot	Total							
No. 1 Canada	Good natural color	1.0%	0.05%	Trace	5.0%	3.0%	1.0%	Nil	1.0%	3.0%	3.0%
No. 2 Canada	Fair color	2.0%	0.05%	About 0.5%	9.5%	5.0%	2.5%	About 0.05%	1.5%	5.0%	5.0%
Extra No. 3 Canada	Fair color	2.0%	0.05%	About 0.5%	13.0%	5.0%	5.0%	About 0.05%	1.5%	5.0%	8.5%
No. 3 Canada	Off color	3.0%	0.05%	1.0%	15.0%	7.0%	5.0%	About 0.2%	4.0%	10.0%	10.0%
Final Grade Name	No. 3 Canada	Over 3.0% grade Peas. Sample Canada "Color or Variety" Account Mixed Colors	Over 0.05% grade Peas. Sample Canada "Color or Variety" Account Ergot	Over 1.0% grade Peas. Sample Canada "Color or Variety" Account Admixture	Over 15.0% grade Peas. Sample Canada "Color or Variety" Account Cracked Seed Coats	Over 7.0% grade Peas. Sample Canada "Color or Variety" Account Shrivelled	Over 5.0% grade Peas. Sample Canada "Color or Variety" Account Splits. Over 5.0% splits and over 3.0% other colors grade Peas. Sample Canada Account Mixed Colors and Splits	Over 0.2% grade Peas. Sample Canada "Color or "Variety Account Heated	Over 4.0% grade Peas Sample Canada "Color or Variety" Account Insect Damage	Over 10.% grade Peas. Sample Canada "Color or Variety" Account Damaged	Over 10.0% grade Peas. Sample Canada "Color or Variety Account Splits and Damage

GREEN PEAS - PRIMARY AND EXPORT GRADE DETERMINANTS

Grade Name	Standard of Quality: Min. Req'mt For Color	Standard of Quality: Other Classes	Standard of Quality: Bleached	Standard of Quality: Total Other Classes and Bleached	Standard of Quality: Foreign Material	Standard of Quality: Cracked Seed Coats Including Splits	Maximum Limits of Damage: Shrivelled	Maximum Limits of Damage: Splits	Maximum Limits of Damage: Heated	Maximum Limits of Damage: Insect Damage	Maximum Limits of Damage: Other Damage	Maximum Limits of Damage: Total Damage and Splits
No. 1 Canada	Good natural color	0.5%	2.0%	2.0%	0.1%	5.0%	2.0%	0.5%	Nil	0.3%	2.0%	3.0%
No. 2 Canada	Fair color	1.0%	3.0%	3.8%	0.2%	8.0%	4.0%	1.0%	1.0%	0.8%	4.0%	5.0%
No. 3 Canada	Off color	2.0%	5.0%	6.5%	0.5%	13.0%	8.0%	5.0%	0.5%	2.5%	10.0%	12.0%
Final Grade Name	No. 3 Canada	Over 2.% up to 10.% grade Peas. Sample Canada "Green or Variety" Account Mixed Colors. Over 10% grade Peas. Sample Canada Account Mixed Colors	Over 5.% grade Peas. Sample Canada "Green or Variety" Account Bleached	Over 6.5% grade Peas. Sample Canada "Green or Variety" Account Mixed Colors and Bleached	Over 0.5% grade Peas. Sample Canada "Green or Variety" Account Admixture	Over 13.% grade Peas. Sample Canada "Green or Variety" Account Cracked Seed Coats	Over 8.% grade Peas. Sample Canada "Green or Variety" Account Shrivelled	Over 5.% grade Peas. Sample Canada "Green or Variety" Account Splits	Over.5% grade Peas. Sample Canada "Green or Variety" Account Heated	Over 2.5% grade Peas. Sample Canada "Green or Variety" Account Insect Damage	Over 10.% grade Peas. Sample Canada "Green or Variety" Account Damaged	Over 12.% grade Peas. Sample Canada "Green or Variety" Account Splits and Damage

At present only the registered varieties are eligible for grades higher than feed grade.

Factors which are considered in grading are:

Foreign material in peas - such as ergot, sclerotinia, mineral matter, other grains and earth pellets
Cracked seed coats
Damaged - includes insect damage, splits, heated or shrivelled peas
Odor - distinct objectionable odor
Peas of other colors or classes
Bleached - one-eighth or more of the surface of the cotyledon bleached to a distinct yellowish tinge
Color - good color refers to peas having a bright, normal color

EXPORT

Export markets for edible peas include many Third World countries, most notably India, Iran, Cuba, Venezuela and several central African nations. In these protein-deficient countries, peas are an important part of Canadian food aid programs.

Dry peas are used primarily in soups or stews, but in protein-deficient countries peas are used in a variety of ways. Bland, starchy foods such as maize and rice are the staple foods in most Third World countries. Peas and other pulses are used to increase the protein content and to add taste and texture. Pea flour is used in porridges, breads, cakes, pastes, sauces and relishes.